

On-Road Heavy-Duty Diesel In-Use Vehicle Emissions Control Measure



Workgroup Meeting
October 5, 2006

California Environmental Protection Agency



Air Resources Board

Overview

- Scope of regulation
- Emission inventory update
- State Implementation Plan update
- Preliminary regulatory concept
- Next steps

Scope of Regulation

- On-road medium & heavy-duty diesel vehicles (>14,000 lbs GVWR)
- Not covered under a current ARB regulation for heavy-duty diesel-fueled vehicles
- Reduce emissions of diesel particulate matter (PM) and oxides of nitrogen (NOx)
- Will apply equally to ALL heavy-duty diesel vehicles traveling in California
 - Out of state vehicles
 - International vehicles
 - California vehicles

Heavy-Duty Diesel Private Fleets Emissions Inventory: Current Status

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Outline

- Introduction to Private Fleets
- Calculating Heavy-Duty Truck (HDT) Emissions
- Improvements in EMFAC2007
- Estimating Private Fleet Emissions

Introduction to Private Fleets

- Private Fleets are privately owned trucks operating in California
 - Heavy-heavy duty diesel trucks (HHDDT, >33,000 lbs)
 - Medium-heavy duty diesel trucks (MHDDT, >14,000 and <33,000 lbs)
 - For hire or private use
 - Trash trucks and other municipal fleets not included
- Emissions are estimated using EMFAC and population data

Calculating HDT Emissions

- EMFAC2007
 - California's emissions inventory model for on-road mobile sources
 - Includes heavy-duty trucks
 - To be released in November, 2006
- Calculating emissions:
 - Population
 - Activity
 - Emission Rates

Calculating Emissions: Population

- Population data are obtained from the Department of Motor Vehicles
 - Review registration by year
 - Obtain model year, engine year, technology distributions, etc. in the heavy-duty truck fleet
 - Summarize data at county level
 - Project population growth into the future
- Population is adjusted for out-of-state trucks
 - Based on ARB funded research studies

Calculating Emissions: Activity

- Activity data are obtained from local transportation planning agencies
 - Obtain vehicle miles traveled (VMT) estimates by geographical region
 - Data are estimated using sophisticated travel modeling techniques and forecasts
 - Data are informed by local and statewide traffic counting programs
- Augmented with special studies and models to estimate heavy-duty truck VMT by vehicle class

Calculating Emissions: Emission Rates

- Emission rates are product of emission factors and mileage accrual by model year
 - Emission factors
 - Zero-mile emission rates
 - Deterioration rates
 - Speed correction factors
 - Mileage accrual
 - ARB research and analysis

EMFAC2007 Model Improvements

- Release in November contains many improvements
 - Reflect latest data and information
 - See <http://www.arb.ca.gov/msei/msei.htm>
- Several improvements affect HHDDT
 - Revised Emission Rates
 - VMT Redistribution

HHDDT Emission Rates

- Major improvement to previous model
 - Incorporates new large data set
 - CRC E-55/59 chassis test data
 - Larger sample size (70 vs 23 trucks)
 - Included testing of 1999-2003 MYs
 - Projection for 2007+ rates based on 2003 MY instead of 1998 MY data
 - Improvements to zero-mile emission rates, deterioration, speed correction factors

HHDDT Emission Rates:

Zero-mile Emission Rates

- Zero-mile emission rates increased in EMFAC2007

Model Year Group	NOx (g/mi)		PM (g/mi)	
	EMFAC2002	Draft Model	EMFAC2002	Draft Model
1987 – 1990	16.8 (4)	22.7 (9)	0.84 (4)	1.88 (9)
1991 – 1993	16.0 (3)	19.6 (10)	0.51 (3)	0.78 (10)
1994 – 1997	19.1 (5)	19.3 (11)	0.32 (5)	0.51 (11)
1999 – 2002	13.4	18.9 (8)	0.21	0.56 (8)
2003 – 2006	6.68	12.5 (4)	0.26	0.35 (4)
2010+	0.67	1.14	0.026	0.035

- Rates in red: projected using ratio of standards
- Numbers in parentheses: number of trucks tested.

HHDDT Emission Factors: Deterioration Rates

- Deterioration in diesel engines is a function of tampering, malmaintenance, & malfunction
 - EMFAC2007 accounts for more malfunctions which may occur in future year engines
 - EMFAC2007 accounts for benefits of on-board diagnostic (OBD) controls designed to reduce the frequency of malfunctions
 - EMFAC2007 accounts for benefits of ARB HDV OBD regulation

HHDDT Emission Factors: Deterioration Rates

- Deterioration rates are in many cases higher

Model Year Group	NOx (g/mi/10,000mi)		PM (g/mi/10,000mi)	
	EMFAC2002	Draft Model	EMFAC2002	Draft Model
1987-1990	0.015	0.026	0.008	0.025
1991-1993	0.030	0.039	0.009	0.014
1994-1997	0.042	0.046	0.010	0.011
1998	0.037	0.053	0.007	0.010
1999-2002	0.013	0.053	0.003	0.010
2003-2006	0.007	0.052	0.003	0.005
2007-2009	0.007	0.047	0.003	0.001
2010+(w/OBD)	0.007	0.041(0.032)	0.003	.001(.0007)

HHDDT Emissions Factors:

Impact of Zero-mile Emission Rate and Deterioration

- Comparison of Emission Rates at 500,000 miles
 - Higher than previously predicted for NOx
 - Lower for 2007+ PM

Model Year Group	NOx (g/mi)		PM (g/mi)	
	EMFAC2002	Draft Model	EMFAC2002	Draft Model
Pre-1975 -1990	29.1 – 17.5	24.0	2.78 – 1.24	3.11
1991 - 2002	17.5 – 14.0	21.6	0.96 – 0.36	1.49 – 1.05
2003 - 2006	7.0	15.2	0.41	0.62
2007 - 2009	4.0	9.2	0.18	0.09
2010+(w/OBD)	1.0	3.2 (2.7)	0.18	0.09 (0.07)

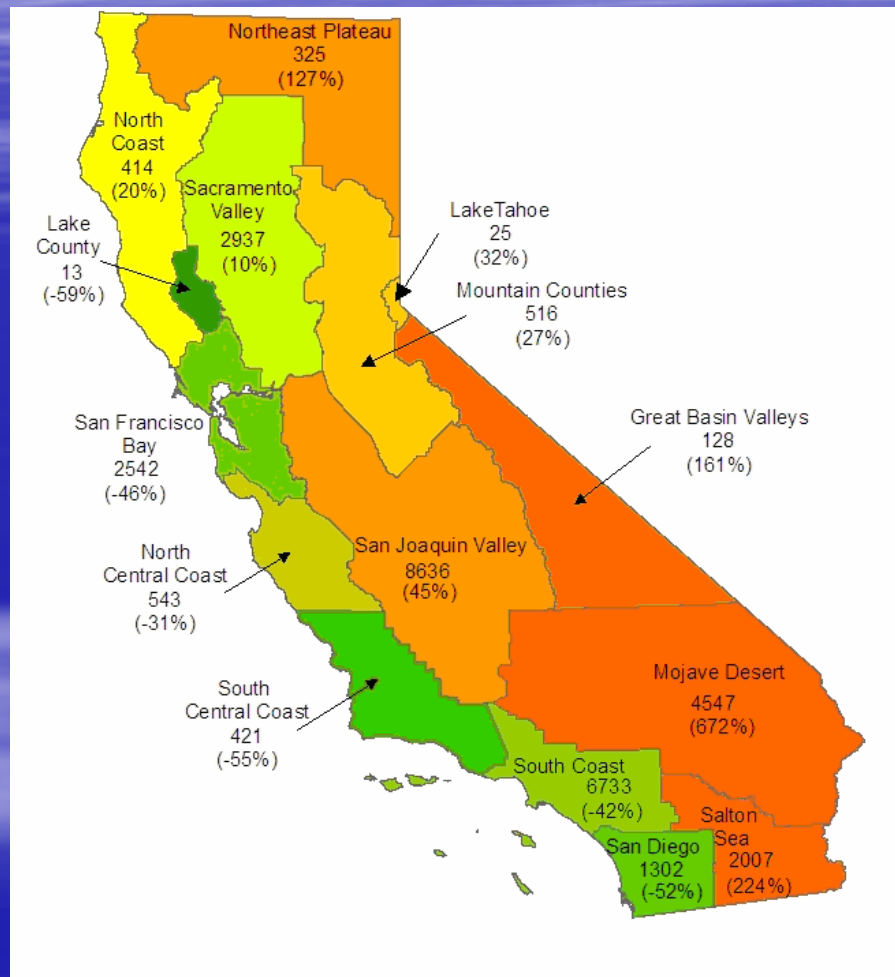
HHDDT Emission Factors: Speed Correction Factors

- Speed correction factors account for varying average emission rates by speed
 - Relative to avg. testing speed 19 mph
- Updated speed correction factors based upon new test data
 - CRC E-55/59 data
 - Different factors for model year groups (Pre-1991; 1991-2002; 2003+)
 - Reflect off-cycle NO_x

HHDDT VMT Redistribution

- EMFAC2007 more accurately accounts for real-world travel patterns in California
- VMT redistributed from urban areas to rural areas
 - Decreased VMT in South Coast and Bay Area
 - Increased VMT in SJV and Mojave Desert
- New distribution based on major Caltrans survey of truck travel in California
- Agrees well with published Caltrans estimates

HHDDT VMT Redistribution

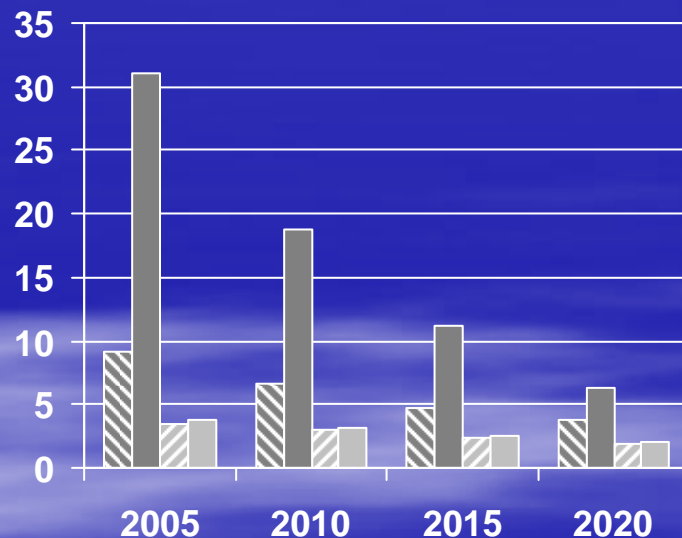


Proposed heavy-heavy duty diesel truck VMT(x1000) and percentage change relative to EMFAC2002 for the year 2010

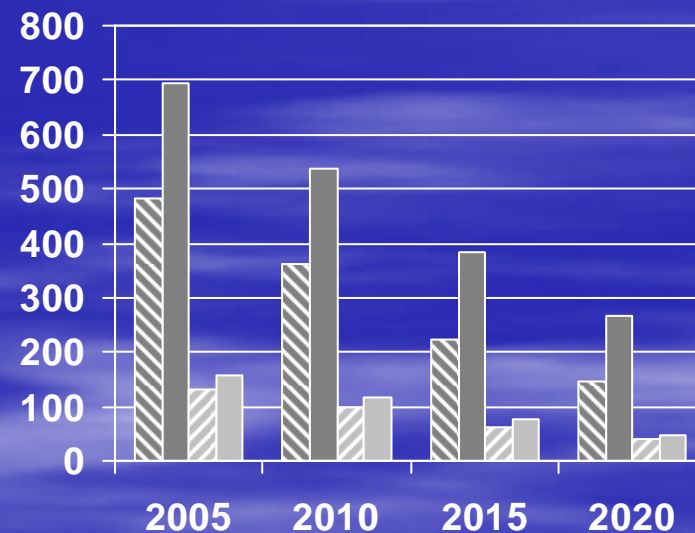
Emissions Impact of Model Improvements

- Major HHDDT Emissions Increase in EMFAC2007
 - Little change in MHDDT emissions

Diesel PM (tons/day)



NOx (tons/day)



■ HHDDT EMFAC2002 ■ HHDDT Draft Model
■ MHDDT EMFAC2002 ■ MHDDT Draft Model

Mobile Source Inventory Workshops

- November 14 – Fresno
- November 15 – Sacramento
- November 16 – El Monte
- Updates will be posted on
<http://www.arb.ca.gov/msei/msei.htm>

Estimating Private Fleet Emissions: Baseline Inventory Adjustments

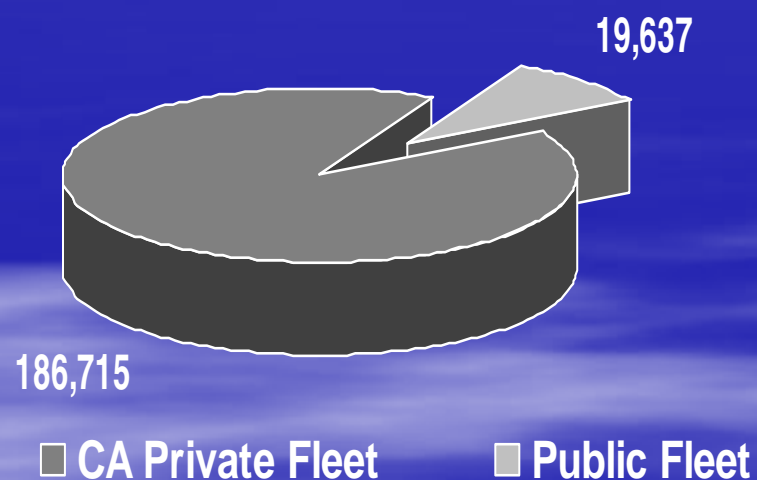
- Baseline inventory adjustments for rules not reflected in draft model
 - Minor adjustment for idling rules –
 - 1.3% reduction (DPM), and 3.2% (NOx) in 2010
 - Chip Reflash
 - Impact is currently unclear
 - Pending lawsuit
 - Currently assume benefit in 1993-1998 trucks
 - Net ~10% NOx reduction

Estimating Private Fleet Emissions: Population Analysis

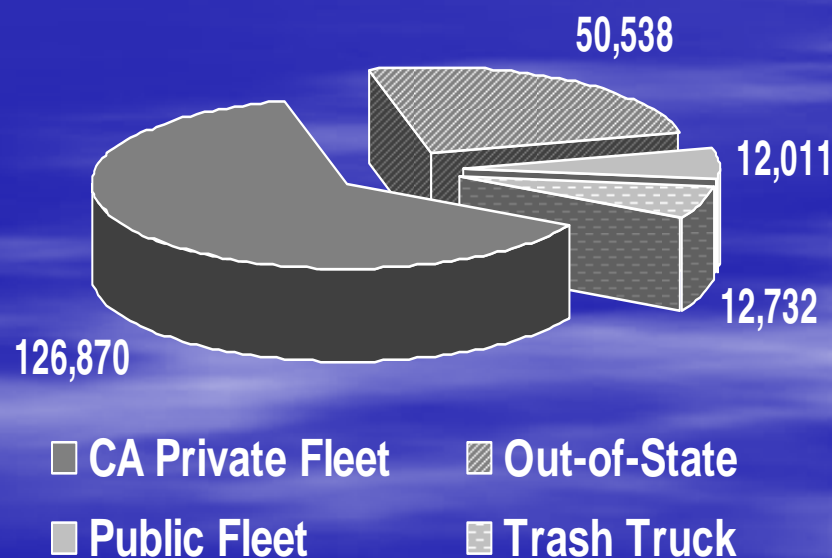
- Use population fractions to estimate emissions
 - Estimate public fleet and solid waste vehicle populations by model year based on rulemakings
 - Identify out-of-state trucks
- The in-state private fleet is the difference between the total fleet and public fleets + out of state trucks
 - 25% HHDDT are out-of-state
- Assume mileage accrual by MY across all fleets
- Allocate emissions to fleets by population fractions by model year and vehicle class

Heavy-Duty Diesel Truck Population Distribution 2006

Medium-Heavy Duty Diesel Truck
(33,000 lbs > GVW > 14,000 lbs)

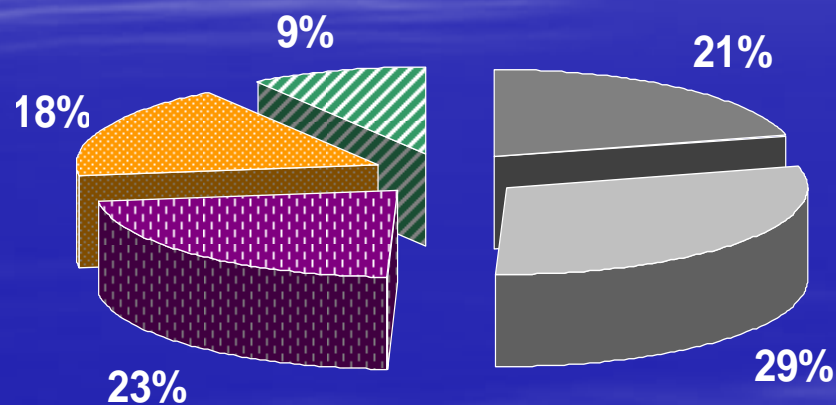


Heavy-Heavy Duty Diesel Truck
(>33,000 lbs)

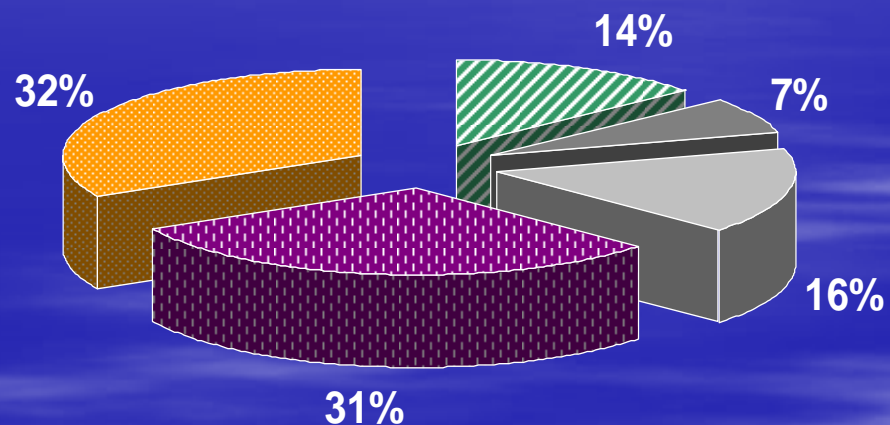


Heavy Duty Diesel Private Fleets* Emissions Inventory Distribution by Model Year (>14,000 lbs, 2006)

Diesel PM (~28 tons/day)



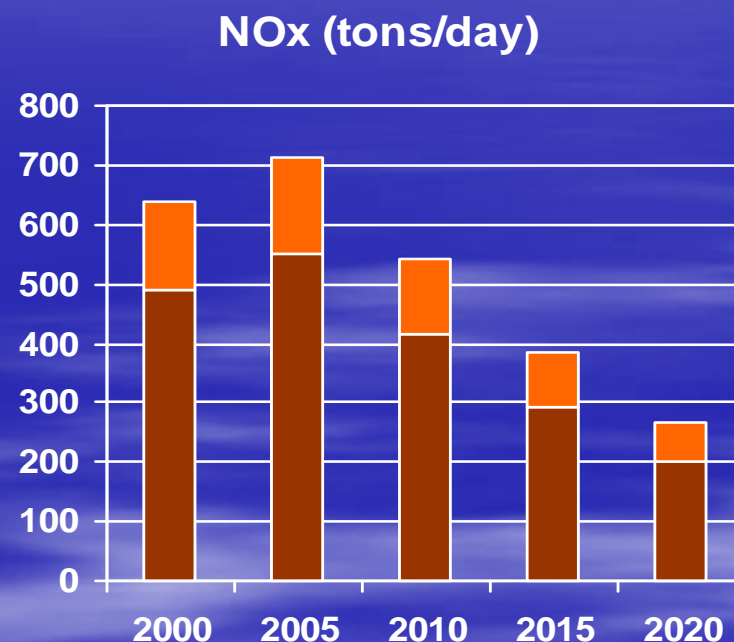
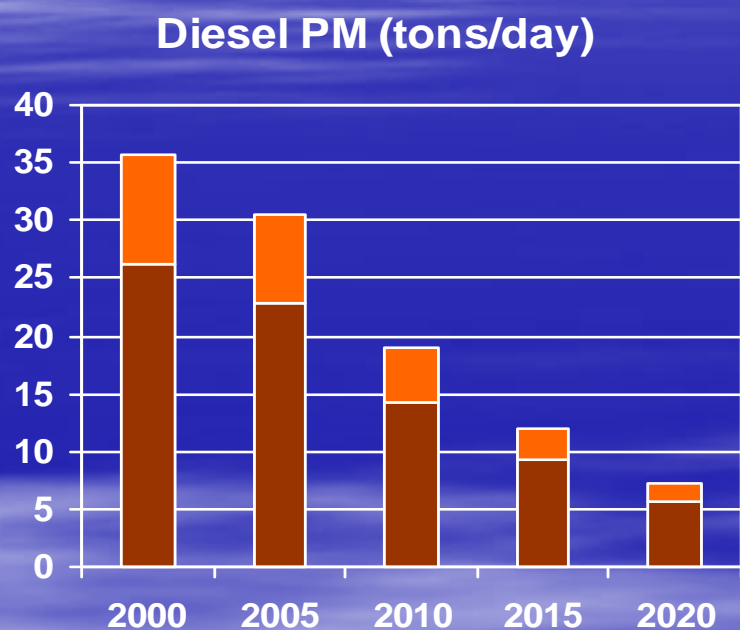
NOx (~680 tons/day)



- MY 1965-87
- MY 1988-93
- MY 1994-98
- MY 1999-02
- MY 2003-06

*Include out-of-state and CA registered

Heavy-Duty Diesel Private Fleets Emissions Inventory



■ Out-of-State
■ CA

Next Steps

- Increase inventory sophistication
 - Improve characterization of in-state vs. out of state mileage accrual
 - ARB funded surveys conducted by UC Davis
 - Working closely with Caltrans and DMV, including IRP databases
 - Improve characterization of private fleets
 - Reviewing DMV Motor Carrier and other databases
 - Evaluate impact of agricultural sector
- Any additional ideas would be appreciated and considered

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State Implementation Plan Update

Air Pollution Reductions Needed for Clean Air Plan

- 15 local areas violate the federal 8-hour ozone standard
- 2 areas violate the federal annual PM2.5 standard
- ARB and districts are currently developing new State Implementation Plans (SIP)
 - A SIP is a master plan that identifies how we will meet federal clean air deadlines

SIP Defines Clean Air Attainment Strategy

- ARB will work with local districts and federal government to achieve reductions
- New reductions will be needed from all categories:
 - Mobile sources
 - On-road and off-road
 - Consumer products/pesticides
 - Stationary sources
 - Goods Movement
 - Evaporative emissions

Pollutants Targeted for Reduction

- Nitrogen oxides (NO_x)
 - Needed for ozone and PM_{2.5} plans
- Reactive organic gases (ROG, VOC, HC, NMOG)
 - Needed for ozone and PM_{2.5} plans
- Directly-emitted particulate matter (PM), especially diesel PM

2007 SIP Planning Milestones

Draft State and local plans and control concepts for public review	Fall 2006
ARB SIP Symposium	October 12, 2006
State and local SIP adoption	Early 2007
Ozone SIP to U.S. EPA	June 2007
PM2.5 SIP to U.S. EPA	February 2008

ARB SIP Symposium

October 12, 2006

- Discuss development of new strategies to attain federal ozone and PM2.5 standards
- Discuss attainment targets and timeline
- Meeting will be held in Sacramento and will be webcast
- For more information, please contact Carol Sutkus at (916) 322-1229 or csutkus@arb.ca.gov

Preliminary Regulatory Concept

Preliminary Regulatory Concept

- Based on best available control technology approach adopted by ARB for in-use vehicles
- Phase-in schedule based on consideration of supply of control technology and retrofit market expansion

BACT Phase-In Concept

- Phase-in of BACT (Best Available Control Technology) for PM and NOx
 - Retrofit
 - Repower with cleaner engine
 - Replace with newer vehicle
- Grouped by model year
 - Previous regulations have similar groupings
 - Compliance deadlines would begin with Group 1 and/or Group 2 vehicles
 - No requirements for 2007 or newer model year vehicles
 - Phase out uncontrolled vehicles older than 10 years

Best Available Control Technology Concept

- An engine or power system certified to the 0.01 g/bhp-hr particulate emission standard; or
- An engine or power system certified to 0.10 g/bhp-hr particulate emission standard used in conjunction with the emission control strategy that achieves the highest level of particulate matter emissions reduction and if available also achieves highest level of oxides of nitrogen reduction
- *Eventual phase out of pre-1994 vehicles*

Availability of Ultra Low Sulfur Diesel Fuel

- Available statewide Sept 1, 2006
 - No operational issues reported
 - No availability issues reported
 - No engine problems reported
- Required nationwide for on-road vehicles this year

2008 Inventory by Model Year

Heavy Duty Diesel Vehicles

(> 14,000 lbs GVWR)

Group #	MY	# of CA Registered Class 8*	# of CA Registered Class 4-7*	# of unique non-CA Registered Vehicles
1	1965-87	16,810	18,386	?
2	1988-93	22,011	26,296	?
3	1994-98	35,092	35,253	?
4	1999-02	25,007	45,358	?
5	2003-06	17,272	43,699	?
6	2007+	11,021	22,873	?
Total		127,213	191,865	?

* Does not include public fleets, urban buses, or solid waste collection vehicles.

Proposed BACT Phase In Schedule

- Begin in 2008
- Phase-out older vehicles first
- Evaluating potential implementation periods
- Must achieve SIP and Diesel Risk Reduction Plan commitments

Exempt from Regulation

- Military tactical vehicles
- Emergency vehicles
- Vehicles that travel less than 1,000 miles annually
 - Exclude use in emergency events

Refine Rule Development

- Review health risks for areas disproportionately impacted
 - Neighborhoods in areas with high truck traffic
 - Business operations in highly populated areas
- Compliance flexibility provisions
- Evaluate expected emissions reductions and Diesel Risk Reduction Plan and SIP goals
- Other opportunities
 - Alternative fuels
 - Other modes of transporting goods

Regulatory Development

- Additional information needed about business practices, fleet characterization
 - Assess cost impacts
 - Evaluate number of vehicles likely to be affected
- Modify staff concept

Additional Information

- Work with associations
- Individual meetings with stakeholders
- Data from representative companies
- Other sources

Next Steps

- Public Workshop in December/January 2006
- Workgroup Meeting(s) in Winter/Spring 2007
- Third Public Workshop in Spring 2007
- ARB Board Meeting – Mid 2007